

Building Regulation Compliance

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Property Reference: 506 Linton House

Issued on Date: 01.Nov.2016

Survey Reference: 506 design

Prop Type Ref:
Property: 506, London

SAP Rating: 84 B **CO2 Emissions (t/year):** 1.44 **DER:** 16.23 Pass **TER:** 25.70 **Percentage DER<TER:** 36.85 %
Environmental: 86 B **General Requirements Compliance:** Pass **DFEE:** 54.37 Pass **TFEE:** 58.76 **Percentage DFEE<TFEE:** 7.46 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 4.4 **ENE2 Credits:** 0.0 **ENE7 Credits:** 0 **CfSH Level:** 4

Surveyor: Mike Ovenden, Tel: 01908 850109 **Surveyor ID:** H824-0001
Address: Dudley Hill, Shenley Church End, Milton Keynes, Buckinghamshire, MK5 6LL
Client: Synergy, 3

Software Version: Elmhurst Energy Systems SAP2012 Calculator (Design System) version 3.06r08
SAP version: SAP 2012, **Regs Region:** England (Part L1A 2013), **Calculation Type:** New Build (As Designed)

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

1a TER and DER

Fuel for main heating:	Electricity	
Fuel factor:	1.55 (electricity)	
Target Carbon Dioxide Emission Rate (TER)	25.70 kg/m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.23 kg/m ²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.76 kWh/m ²	
Dwelling Fabric Energy Efficiency (DFEE)	54.37 kWh/m ²	OK

2 Fabric U-values

Element	Average	Highest	
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings and curtain wall	0.81 (max. 2.00)	0.89 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Heat pump with radiators or underfloor - Electric
	Air-to-water heat pump
Secondary heating system:	None

5 Cylinder insulation

Hot water storage	Nominal cylinder loss: 1.82 kWh/day	
	Permitted by DBSCG 2.10	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls:	Time and temperature zone control	OK
Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:	100%	
Minimum	75%	OK

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.61

Maximum	1.5	OK
MVHR efficiency:	78%	
Minimum:	70%	OK

9 Summertime temperature

Overheating risk (Thames Valley):	Medium	OK
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Based On:

Overshading:	Average
Windows facing North:	22.16 m ² , No overhang
Windows facing East:	14.58 m ² , No overhang
Windows facing West:	33.05 m ² , No overhang
Air change rate:	8.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m ² K
Party wall U-value	0.00 W/m ² K
Roof U-value	0.10 W/m ² K
Roof U-value	0.10 W/m ² K
Window U-value	0.78 W/m ² K
Thermal bridging y-value	0.033 W/m ² K
Photovoltaic array	

Full SAP Calculation Printout

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Survey Reference: 506 design

Issued on Date: 01.Nov.2016
Prop Type Ref:

Property: 506, London

SAP Rating: 84 B CO2 Emissions (t/year): 1.44 DER: 16.23 Pass TER: 25.70 Percentage DER<TER: 36.85 %
Environmental: 86 B General Requirements Compliance: Pass DFEE: 54.37 Pass TFE: 58.76 Percentage DFEE<TFEE: 7.46 %

CfSH Results Version: November 2010 - June 2014 Addendum ENE1 Credits: 4.4 ENE2 Credits: 0.0 ENE7 Credits: 0 CfSH Level: 4
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SAP version: SAP 2012, Regs Region: England (Part L1A 2013), Calculation Type: New Build (As Designed)

CALCULATION DETAILS for survey reference no '506 design'
SAP2012 - 9.92 input data (DesignData) -

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SAP2012 Input Data (Flat) 01/11/2016

FullRefNo: 506 design

Regs Region: England
SAP Region: Thames Valley
Postcode:
DwellingOrientation: East
Property Type: Flat, End-Terrace
Storeys: 2
Date Built: 2016
Sheltered Sides: 2
Sunlight Shade: Average or unknown
Measurements: Perimeter, Floor Area, Storey Height
1st Storey: 20.3, 86.69, 2.6
2nd Storey: 15.12, 26.57, 2.85
Living Area: 31.76 m2, fraction: 28.0%
Thermal Mass: Simple calculation
Thermal Mass Simple: Low
Thermal MassValue: 100
External Walls: Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1: 14.02, 52.79, 0, Other, CurtainWalling, 0, 0.89, Calculate
External Wall 2: 12.06, 43.08, 0, Other, CurtainWalling, 0, 0.89, Gross
Party Walls: Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
Party Wall 1: 59.09, 20, PartyWallSteelFrame, Solid, 0, 0
Party Wall 2: 25.42, 20, PartyWallSteelFrame, Solid, 0, 0
External Roofs: Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
penthouse roof: 61.12, 61.12, 0, Other, 0.1
garden room roof: 25.57, 25.57, 0, Other, 0.1
Heat Loss Floors: Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
penthouse floor: 86.69, 0, Other, Ground Floor - Solid, 0, 0.15
Description: Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
Opening Type 1: Manufacturer, Window, Double Low-E Soft 0.05, , , 0.36, , 1,
Openings: Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
1 Window, External Wall 1, West, , None, 0, , 0, 0, 3.89,
2 Window, External Wall 1, East, , None, 0, , 0, 0, 7.29,
3 Window, External Wall 1, East, , None, 0, , 0, 0, 7.29,
4 Window, External Wall 1, West, , None, 0, , 0, 0, 7.29,
1gh Window, External Wall 2, West, , None, 0, , 0, 0, 21.87,
5 Window, External Wall 1, North, , None, 0, , 0, 0, 4.37,
6 Window, External Wall 1, North, , None, 0, , 0, 0, 6.48,
7 Window, External Wall 1, North, , None, 0, , 0, 0, 2.16,
2gh Window, External Wall 2, North, , None, 0, , 0, 0, 9.15,
Conservatory: None
Draught Proofing: 100
Draught Lobby: No
Thermal Bridges: Calculate Bridges
Bridging: Y
List of Bridges: 0.033
0. Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
1. External wall, E1 Steel lintel with perforated steel base plate, , No, 0, 0, 0, 0.00,
2. External wall, E2 Other lintels (including other steel lintels), , No, 0, 0, 0, 0.00,
3. External wall, E3 Sill, , No, 0, 0, 0, 0.00,
4. External wall, E4 Jamb, , No, 0, 0, 0, 0.00,
5. External wall, E5 Ground floor (normal), Table K1 - Approved, No, 20.3, 0.16, 0.16, 3.25,
6. External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
7. External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
8. External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
9. External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
10. External wall, E6 Intermediate floor within a dwelling, Table K1 - Approved, Yes, 15.12, 0.07, 0.07, 1.06,
11. External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, Yes, 20.3, 0.07, 0.07, 1.42,
12. External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
13. External wall, E9 Balcony between dwellings, wall insulation continuous, , No, 0, 0, 0, 0.00,
14. External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation, , No, 0, 0, 0, 0.00,
15. External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
16. External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
17. External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
18. External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
19. External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
20. External wall, E14 Flat roof, Table K1 - Default, No, 20.3, 0.08, 0.08, 1.62,
21. External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
22. External wall, E16 Corner (normal), Table K1 - Approved, Yes, 10.9, 0.09, 0.09, 0.98,
23. External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
24. External wall, E18 Party wall between dwellings, Table K1 - Approved, Yes, 10.9, 0.06, 0.06, 0.65,
25. External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
26. Party wall, P1 Party wall - Ground floor, , No, 0, 0, 0, 0.00,
27. Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
28. Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), , No, 0, 0, 0, 0.00,

29. Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
30. Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
31. Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
32. Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
33. External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
34. External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
35. External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
36. External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
37. External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
38. External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
39. External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
40. External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
41. External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test: True
Designed q50: 5
AsBuilt q50: 15
Property Tested: False
Mechanical Ventilation
MV System Present Yes
Windows In Hot Weather Windows fully open
Cross Ventilation Yes
Night Ventilation No
Air Change Rate 8.00
Approved Installation Yes
DataType Database
Type Balanced mechanical ventilation with heat recovery
Database Ref Number 500320
Configuration 2
HR Duct Insulated No
ManufacturersSFP 0.61
DuctType Rigid
HR Efficiency 78
Wet Rooms 2
Chimneys MHS: 0
Chimneys SHS: 0
Chimneys Other: 0
Chimneys Total: 0
Open Flues MHS: 0
Open Flues SHS: 0
Open Flues Other: 0
Open Flues Total: 0
Intermittent Fans: 0
Passive Vents: 0
Flueless Gas Fires: 0
Cooling System
Cooled Area 80.36
Data Source SAP table
Type Split or Multi-Split
Class A
Control On/Off
Light Fittings: 52
LEL Fittings: 52
Percentage of LEL Fittings: 100
External Lights Fitted: Yes
External LELs Fitted: Yes
Electricity Tariff: Standard
Main Heating 1
Description ashp
Percentage 100
MHS Electricity PET Heat pump air-to-water
SAP Code 224
Boiler Efficiency Type SAP Table
Efficiency 170
Controls by PCDF 0
MHS Controls CHD Time and temperature zone control
Boiler Interlock No
Ctrl SAP Code 2207
MCS Installation CertificateNo
Pumped Pump in heated space
Heat Pump Age 2013 or later
Heat Emitter Radiators and Underfloor
Flow Temperature <= 35°C
Under Floor Heating Yes - Pipes in thin screed
Main Heating 2 None
Heating Systems Interaction Each system heats separate parts of dwelling
Smoke Control Area Unknown
Community Heating None
Secondary Heating None
Water Heating
Type MainHeating1
WHS HWP From main heating 1
Low Water Usage Yes
SAP Code 991
Showers in Property Non-electric only
Supplementary Immersion No
Hot Water Cylinder
Cylinder Type HotWaterCylinder
Cylinder Insulation Type Foam
Cylinder Volume 180.00
Cylinder Stat Yes
Pipeworks Insulated Fully insulated primary pipework
Cylinder in Heated Space Yes
Separate Time Control Yes
Flue Gas Heat Recovery System None
Waste Water Heat Recovery none
PV Unit
Type One Dwelling
PVUnit 1 Cells Peak = 1.64, Orientation = South, Elevation = 30°, Overshading = None Or Little, , Connected to Dwelling = Yes
Wind Turbine None
Terrain Type: Urban
Small Scale Hydro None
Special Features None

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Top-floor flat, total floor area 113 m²

This report covers items included within the SAP calculations.
 It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Electricity
 Fuel factor:1.55 (electricity)
 Target Carbon Dioxide Emission Rate (TER) 25.70 kg/m²
 Dwelling Carbon Dioxide Emission Rate (DER) 16.23 kg/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)58.8 kWh/m²
 Dwelling Fabric Energy Efficiency (DFEE)54.4 kWh/m²OK

2 Fabric U-values

Element	Average	Highest	
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings and curtain wall	0.81 (max. 2.00)	0.89 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Heat pump with radiators or underfloor - Electric
Air-to-water heat pump	

Secondary heating system:	None
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5 Cylinder insulation

Hot water storage	Nominal cylinder loss: 1.82 kWh/day	
Permitted by DBSCG 2.10	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls:	Time and temperature zone control	OK
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Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%	
Minimum	75%

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.61
Maximum	1.5
MVHR efficiency:	78%
Minimum:	70%

9 Summertime temperature

Overheating risk (Thames Valley):	Medium	OK
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Based on:

Overshading:	Average
Windows facing North:	22.16 m ² , No overhang
Windows facing East:	14.58 m ² , No overhang
Windows facing West:	33.05 m ² , No overhang
Air change rate:	8.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m ² K
Party wall U-value	0.00 W/m ² K
Roof U-value	0.10 W/m ² K
Roof U-value	0.10 W/m ² K
Window U-value	0.78 W/m ² K
Thermal bridging y-value	0.033 W/m ² K
Photovoltaic array	

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	86.6900 (1b)	x 2.6000 (2b)	= 225.3940 (1b) - (3b)
First floor	26.5700 (1c)	x 2.8500 (2c)	= 75.7245 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	301.1185 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Measured/design q50		5.0000
Infiltration rate		0.2500 (18)
Number of sides sheltered		2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2125 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												54.6000 (23c)
Effective ac	0.4979	0.4926	0.4873	0.4608	0.4554	0.4289	0.4289	0.4236	0.4395	0.4554	0.4661	0.4767 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Opening Type 1 (Uw = 0.78)			69.7900	0.7564	52.7892		(27)
penthouse floor			86.6900	0.1500	13.0035		(28a)
External Wall 1	52.7900	38.7700	14.0200	0.8900	12.4778		(29a)
External Wall 2	43.0800	31.0200	12.0600	0.8900	10.7334		(29a)
penthouse roof	61.1200		61.1200	0.1000	6.1120		(30)
garden room roof	25.5700		25.5700	0.1000	2.5570		(30)
Total net area of external elements Aum(A, m2)			269.2500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		97.6729		(33)
Party Wall 1			59.0900	0.0000	0.0000		(32)
Party Wall 2			25.4200	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.9864 (36)
Total fabric heat loss	(33) + (36) =	106.6593 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	49.4796	48.9517	48.4238	45.7843	45.2564	42.6169	42.6169	42.0890	43.6727	45.2564	46.3122	47.3680 (38)
Heat transfer coeff	156.1389	155.6110	155.0831	152.4436	151.9157	149.2762	149.2762	148.7483	150.3320	151.9157	152.9715	154.0273 (39)
Average = Sum(39)m / 12 =												152.3116 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3786	1.3739	1.3693	1.3460	1.3413	1.3180	1.3180	1.3133	1.3273	1.3413	1.3506	1.3599 (40)
HLP (average)												1.3448 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.8330 (42)
Average daily hot water use (litres/day)		101.4847 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.6332	107.5738	103.5144	99.4551	95.3957	91.3363	91.3363	95.3957	99.4551	103.5144	107.5738	111.6332 (44)
Energy conte	165.5488	144.7901	149.4104	130.2596	124.9872	107.8544	99.9430	114.6860	116.0558	135.2518	147.6379	160.3252 (45)
Energy content (annual)										Total = Sum(45)m =		1596.7503 (45)
Distribution loss (46)m = 0.15 x (45)m	24.8323	21.7185	22.4116	19.5389	18.7481	16.1782	14.9914	17.2029	17.4084	20.2878	22.1457	24.0488 (46)
Water storage loss:												
Store volume												180.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0115 (51)
Volume factor from Table 2a												0.8736 (52)
Temperature factor from Table 2b												0.5400 (53)

Enter (49) or (54) in (55)												0.9805 (55)
Total storage loss	30.3965	27.4549	30.3965	29.4160	30.3965	29.4160	30.3965	30.3965	29.4160	30.3965	29.4160	30.3965 (56)
If cylinder contains dedicated solar storage	30.3965	27.4549	30.3965	29.4160	30.3965	29.4160	30.3965	30.3965	29.4160	30.3965	29.4160	30.3965 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	219.2077	193.2562	203.0693	182.1875	178.6461	159.7824	153.6019	168.3449	167.9837	188.9107	199.5659	213.9841 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum(63)m =			0.0000 (63)
Output from w/h	219.2077	193.2562	203.0693	182.1875	178.6461	159.7824	153.6019	168.3449	167.9837	188.9107	199.5659	213.9841 (64)
								Total per year (kwh/year) =	Sum(64)m =			2228.5403 (64)
Heat gains from water heating, kWh/month	97.9721	86.9156	92.6061	84.8537	84.4853	77.4040	76.1582	81.0602	80.1309	87.8983	90.6320	96.2352 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6198	21.8671	17.7835	13.4632	10.0639	8.4964	9.1807	11.9334	16.0169	20.3372	23.7365	25.3040 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	276.1590	279.0247	271.8033	256.4298	237.0236	218.7844	206.5996	203.7339	210.9553	226.3288	245.7350	263.9742 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217 (71)
Water heating gains (Table 5)	131.6829	129.3386	124.4705	117.8523	113.5556	107.5055	102.3631	108.9519	111.2929	118.1429	125.8777	129.3484 (72)
Total internal gains	500.9574	498.7260	482.5529	456.2410	429.1387	403.2820	386.6390	393.1148	406.7608	433.3045	463.8449	487.1223 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	22.1600	10.6334	0.3600	1.0000	0.7700	58.7865 (74)
East	14.5800	19.6403	0.3600	1.0000	0.7700	71.4399 (76)
West	33.0500	19.6403	0.3600	1.0000	0.7700	161.9401 (80)

Solar gains	292.1665	568.8847	942.7575	1403.1736	1756.9145	1817.8674	1722.5417	1452.5498	1103.9650	675.4549	363.5181	240.9277 (83)
Total gains	793.1238	1067.6108	1425.3104	1859.4146	2186.0532	2221.1493	2109.1807	1845.6646	1510.7257	1108.7594	827.3630	728.0499 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nli,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.1494	20.2178	20.2866	20.6379	20.7096	21.0758	21.0758	21.1506	20.9278	20.7096	20.5666	20.4257
alpha	2.3433	2.3479	2.3524	2.3759	2.3806	2.4051	2.4051	2.4100	2.3952	2.3806	2.3711	2.3617
util living area	0.9564	0.9178	0.8400	0.7010	0.5415	0.3960	0.2982	0.3486	0.5653	0.8161	0.9320	0.9635 (86)
MIT	18.8590	19.2113	19.7303	20.2878	20.6334	20.8039	20.8576	20.8433	20.6841	20.1386	19.3881	18.8066 (87)
Th 2	19.7798	19.7834	19.7870	19.8050	19.8086	19.8268	19.8268	19.8304	19.8195	19.8086	19.8014	19.7942 (88)
util rest of house	0.9494	0.9054	0.8174	0.6635	0.4902	0.3323	0.2233	0.2673	0.4946	0.7809	0.9196	0.9577 (89)
MIT 2	16.9410	17.4468	18.1783	18.9444	19.3835	19.5949	19.6462	19.6401	19.4720	18.7777	17.7210	16.8748 (90)
Living area fraction	17.4788	17.9416	18.6135	19.3211	19.7340	19.9339	19.9859	19.9775	19.8119	19.1593	18.1885	17.4165 (91)
MIT	17.4788	17.9416	18.6135	19.3211	19.7340	19.9339	19.9859	19.9775	19.8119	19.1593	18.1885	17.4165 (92)
Temperature adjustment												0.0000
adjusted MIT	17.4788	17.9416	18.6135	19.3211	19.7340	19.9339	19.9859	19.9775	19.8119	19.1593	18.1885	17.4165 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9314	0.8813	0.7913	0.6467	0.4868	0.3384	0.2337	0.2779	0.4941	0.7580	0.8975	0.9415 (94)
Ext temp.	738.6760	940.8635	1127.8211	1202.4507	1064.0868	751.5502	492.9683	512.9660	746.4120	840.4206	742.5784	685.4678 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	2057.7268	2029.4154	1878.5982	1588.6343	1220.4931	796.2305	505.4378	532.1484	858.6767	1300.2953	1696.2275	2035.7008 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	981.3738	731.5069	558.5782	278.0522	116.3663	0.0000	0.0000	0.0000	0.0000	342.1468	686.6274	1004.5733 (98)
												4699.2249 (98)
												(98) / (4) = 41.4906 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1403.1963	1104.6439	1130.4871	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8879	0.9200	0.8954	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1245.8566	1016.3174	1012.2793	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2691.5626	2558.5249	2252.1433	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												

Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	1040.9084	1147.4024	922.4588	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												3110.7696 (104)
Intermittency factor (Table 10b)												0.7095 (105)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kwh	0.0000	0.0000	0.0000	0.0000	0.0000	184.6358	203.5256	163.6253	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												551.7867 (107)
Space cooling per m2												4.8719 (108)

 9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												170.0000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2764.2499 (211)
Cooling System Energy Efficiency Ratio (see Table 10c)												4.0000 (209)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	981.3738	731.5069	558.5782	278.0522	116.3663	0.0000	0.0000	0.0000	0.0000	342.1468	686.6274	1004.5733 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	577.2787	430.2982	328.5754	163.5601	68.4508	0.0000	0.0000	0.0000	0.0000	201.2628	403.8985	590.9255 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	219.2077	193.2562	203.0693	182.1875	178.6461	159.7824	153.6019	168.3449	167.9837	188.9107	199.5659	213.9841 (64)
Efficiency of water heater (217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kwh/month	128.9457	113.6801	119.4525	107.1691	105.0859	93.9896	90.3540	99.0264	98.8139	111.1239	117.3917	125.8730 (219)
Water heating fuel used												1310.9061 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	46.1589	50.8814	40.9063	0.0000	0.0000	0.0000	0.0000 (221)
Cooling												137.9467 (221)
Annual totals kwh/year												
Space heating fuel - main system												2764.2499 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7625)												
mechanical ventilation fans (SFP = 0.7625)												280.1155 (230a)
central heating pump												30.0000 (230c)
Total electricity for the above, kwh/year												310.1155 (231)
Electricity for lighting (calculated in Appendix L)												434.7930 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.64 * 1000 * 1.00) =										-1416.3363		-1416.3363 (233)
Total delivered energy for all uses												3541.6748 (238)

 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kwh/year	Emission factor kg CO2/kwh	Emissions kg CO2/year
Space heating - main system 1	2764.2499	0.5190	1434.6457 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1310.9061	0.5190	680.3603 (264)
Space and water heating			2115.0060 (265)
Space cooling	137.9467	0.5190	71.5943 (266)
Pumps and fans	310.1155	0.5190	160.9499 (267)
Energy for lighting	434.7930	0.5190	225.6576 (268)
Energy saving/generation technologies			
PV Unit	-1416.3363	0.5190	-735.0785 (269)
Total CO2, kg/year			1838.1292 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.2300 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER			16.2300 ZC1
Total Floor Area		TFA	113.2600
Assumed number of occupants		N	2.8330
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			14.4487 ZC2
CO2 emissions from cooking, equation (L16)			1.6510 ZC3
Total CO2 emissions			32.3297 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kwh/m2/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			32.3297 ZC8

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF STANDARD ENE7 CO2 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	86.6900 (1b)	x 2.6000 (2b)	= 225.3940 (1b) - (3b)
First floor	26.5700 (1c)	x 2.8500 (2c)	= 75.7245 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	301.1185 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design q50					5.0000
Infiltration rate					0.2500 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2125 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												54.6000 (23c)
Effective ac	0.4979	0.4926	0.4873	0.4608	0.4554	0.4289	0.4289	0.4236	0.4395	0.4554	0.4661	0.4767 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 0.78)			69.7900	0.7564	52.7892		(27)
penthouse floor			86.6900	0.1500	13.0035		(28a)
External Wall 1	52.7900	38.7700	14.0200	0.8900	12.4778		(29a)
External Wall 2	43.0800	31.0200	12.0600	0.8900	10.7334		(29a)
penthouse roof	61.1200		61.1200	0.1000	6.1120		(30)
garden room roof	25.5700		25.5700	0.1000	2.5570		(30)
Total net area of external elements Aum(A, m ²)			269.2500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		97.6729		(33)
Party Wall 1			59.0900	0.0000	0.0000		(32)
Party Wall 2			25.4200	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9864 (36)
Total fabric heat loss						(33) + (36) =	106.6593 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	49.4796	48.9517	48.4238	45.7843	45.2564	42.6169	42.6169	42.0890	43.6727	45.2564	46.3122	47.3680 (38)
Heat transfer coeff	156.1389	155.6110	155.0831	152.4436	151.9157	149.2762	149.2762	148.7483	150.3320	151.9157	152.9715	154.0273 (39)
Average = Sum(39)m / 12 =												152.3116 (39)
HLP	1.3786	1.3739	1.3693	1.3460	1.3413	1.3180	1.3180	1.3133	1.3273	1.3413	1.3506	1.3599 (40)
HLP (average)												1.3448 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8330 (42)
Average daily hot water use (litres/day)												101.4847 (43)
Daily hot water use	111.6332	107.5738	103.5144	99.4551	95.3957	91.3363	91.3363	95.3957	99.4551	103.5144	107.5738	111.6332 (44)
Energy conte	165.5488	144.7901	149.4104	130.2596	124.9872	107.8544	99.9430	114.6860	116.0558	135.2518	147.6379	160.3252 (45)
Energy content (annual)										Total = Sum(45)m =		1596.7503 (45)
Distribution loss (46)m = 0.15 x (45)m	24.8323	21.7185	22.4116	19.5389	18.7481	16.1782	14.9914	17.2029	17.4084	20.2878	22.1457	24.0488 (46)
Water storage loss:												
Store volume												150.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0191 (51)
Volume factor from Table 2a												0.9283 (52)
Temperature factor from Table 2b												0.5400 (53)

Enter (49) or (54) in (55)	1.4364 (55)											
Total storage loss	44.5282	40.2190	44.5282	43.0918	44.5282	43.0918	44.5282	44.5282	43.0918	44.5282	43.0918	44.5282 (56)
If cylinder contains dedicated solar storage	44.5282	40.2190	44.5282	43.0918	44.5282	43.0918	44.5282	44.5282	43.0918	44.5282	43.0918	44.5282 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	233.3394	206.0203	217.2010	195.8634	192.7778	173.4582	167.7336	182.4766	181.6596	203.0424	213.2417	228.1158 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	233.3394	206.0203	217.2010	195.8634	192.7778	173.4582	167.7336	182.4766	181.6596	203.0424	213.2417	228.1158 (64)
Heat gains from water heating, kWh/month	109.2775	97.1269	103.9114	95.7944	95.7907	88.3446	87.4635	92.3656	91.0716	99.2037	101.5726	107.5406 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6198	21.8671	17.7835	13.4632	10.0639	8.4964	9.1807	11.9334	16.0169	20.3372	23.7365	25.3040 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	276.1590	279.0247	271.8033	256.4298	237.0236	218.7844	206.5996	203.7339	210.9553	226.3288	245.7350	263.9742 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217 (71)
Water heating gains (Table 5)	146.8783	144.5340	139.6659	133.0477	128.7510	122.7009	117.5585	124.1473	126.4883	133.3383	141.0731	144.5438 (72)
Total internal gains	516.1527	513.9214	497.7483	471.4364	444.3341	418.4773	401.8343	408.3102	421.9562	448.4999	479.0403	502.3176 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	22.1600	10.6334	0.3600	1.0000	0.7700	58.7865 (74)
East	14.5800	19.6403	0.3600	1.0000	0.7700	71.4399 (76)
West	33.0500	19.6403	0.3600	1.0000	0.7700	161.9401 (80)

Solar gains	292.1665	568.8847	942.7575	1403.1736	1756.9145	1817.8674	1722.5417	1452.5498	1103.9650	675.4549	363.5181	240.9277 (83)
Total gains	808.3192	1082.8061	1440.5058	1874.6100	2201.2486	2236.3447	2124.3760	1860.8599	1525.9211	1123.9548	842.5583	743.2453 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nll,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.1494	20.2178	20.2866	20.6379	20.7096	21.0758	21.0758	21.1506	20.9278	20.7096	20.5666	20.4257
alpha	2.3433	2.3479	2.3524	2.3759	2.3806	2.4051	2.4051	2.4100	2.3952	2.3806	2.3711	2.3617
util living area	0.9547	0.9157	0.8374	0.6981	0.5388	0.3937	0.2963	0.3461	0.5615	0.8124	0.9297	0.9620 (86)
MIT	18.3167	18.7840	19.4718	20.2083	20.6646	20.8883	20.9591	20.9401	20.7318	20.0135	19.0192	18.2463 (87)
Th 2	19.7798	19.7834	19.7870	19.8050	19.8086	19.8268	19.8268	19.8304	19.8195	19.8086	19.8014	19.7942 (88)
util rest of house	0.9475	0.9031	0.8145	0.6605	0.4876	0.3303	0.2218	0.2653	0.4909	0.7767	0.9169	0.9559 (89)
MIT 2	17.3665	17.8245	18.4862	19.1783	19.5742	19.7649	19.8110	19.8056	19.6548	19.0306	18.0752	17.3070 (90)
Living area fraction	17.6330	18.0936	18.7626	19.4671	19.8800	20.0799	20.1329	20.1238	19.9568	19.3062	18.3399	17.5704 (92)
MIT	17.6330	18.0936	18.7626	19.4671	19.8800	20.0799	20.1329	20.1238	19.9568	19.3062	18.3399	17.5704 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9304	0.8808	0.7918	0.6488	0.4908	0.3444	0.2417	0.2862	0.4997	0.7591	0.8967	0.9405 (94)
Ext temp.	752.0652	953.7041	1140.5332	1216.2986	1080.4618	770.2775	513.3666	532.5896	762.4484	853.1655	755.5144	699.0131 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	2081.7939	2053.0637	1901.7172	1610.8913	1242.6651	818.0211	527.3847	553.9030	880.4714	1322.6056	1719.3869	2059.4031 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	989.3182	738.7696	566.3209	284.1067	120.6793	0.0000	0.0000	0.0000	0.0000	349.2635	693.9882	1012.1302 (98)
												4754.5766 (98)
												(98) / (4) = 41.9793 (99)

8c. Space cooling requirement

Not applicable

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER	15.9400 ZC1											
Total Floor Area	113.2600											
Assumed number of occupants	2.8330											
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190											
CO2 emissions from appliances, equation (L14)	14.4487 ZC2											
CO2 emissions from cooking, equation (L16)	1.6510 ZC3											
Total CO2 emissions	32.0397 ZC4											

Residual CO2 emissions offset from biofuel CHP	0.0000	ZC5
Additional allowable electricity generation, kWh/m ² /year	0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation	0.0000	ZC7
Net CO2 emissions	32.0397	ZC8

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	86.6900 (1b)	x 2.6000 (2b)	= 225.3940 (1b) - (3b)
First floor	26.5700 (1c)	x 2.8500 (2c)	= 75.7245 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 301.1185 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1328 (8)
Pressure test					Yes
Measured/design q50					5.0000
Infiltration rate					0.3020 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3254 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4149	0.4068	0.3986	0.3580	0.3498	0.3091	0.3091	0.3010	0.3254	0.3498	0.3661	0.3824 (22b)
Effective ac	0.5861	0.5827	0.5795	0.5641	0.5612	0.5478	0.5478	0.5453	0.5529	0.5612	0.5670	0.5731 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opening Type Curtain (Uw = 1.50)			28.3200	1.4151	40.0755		(27)
penthouse floor			86.6900	0.1300	11.2697		(28a)
External Wall 1	52.7900	15.7400	37.0500	0.1800	6.6690		(29a)
External Wall 2	43.0800	12.5800	30.5000	0.1800	5.4900		(29a)
penthouse roof	61.1200		61.1200	0.1300	7.9456		(30)
garden room roof	25.5700		25.5700	0.1300	3.3241		(30)
Total net area of external elements Aum(A, m2)			269.2500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7739		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9280 (36)
Total fabric heat loss						(33) + (36) =	82.7019 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	58.2374	57.9053	57.5797	56.0507	55.7646	54.4328	54.4328	54.1862	54.9458	55.7646	56.3433	56.9484 (38)
Heat transfer coeff	140.9393	140.6071	140.2816	138.7525	138.4665	137.1347	137.1347	136.8881	137.6477	138.4665	139.0452	139.6502 (39)
Average = Sum(39)m / 12 =												138.7512 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2444	1.2415	1.2386	1.2251	1.2226	1.2108	1.2108	1.2086	1.2153	1.2226	1.2277	1.2330 (40)
HLP (average)												1.2251 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8330 (42)
Average daily hot water use (litres/day)												101.4847 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	111.6332	107.5738	103.5144	99.4551	95.3957	91.3363	91.3363	95.3957	99.4551	103.5144	107.5738	111.6332 (44)
Energy content (annual)	165.5488	144.7901	149.4104	130.2596	124.9872	107.8544	99.9430	114.6860	116.0558	135.2518	147.6379	160.3252 (45)
Distribution loss (46)m = 0.15 x (45)m	24.8323	21.7185	22.4116	19.5389	18.7481	16.1782	14.9914	17.2029	17.4084	20.2878	22.1457	24.0488 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	214.7915	189.2673	198.6531	177.9138	174.2299	155.5086	149.1857	163.9287	163.7100	184.4945	195.2921	209.5679 (62)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	214.7915	189.2673	198.6531	177.9138	174.2299	155.5086	149.1857	163.9287	163.7100	184.4945	195.2921	209.5679 (64)
Heat gains from water heating, kWh/month	94.4391	83.7245	89.0731	81.4347	80.9524	73.9850	72.6252	77.5272	76.7119	84.3654	87.2130	92.7023 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 2176.5430 (64)												

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6198	21.8671	17.7835	13.4632	10.0639	8.4964	9.1807	11.9334	16.0169	20.3372	23.7365	25.3040 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	276.1590	279.0247	271.8033	256.4298	237.0236	218.7844	206.5996	203.7339	210.9553	226.3288	245.7350	263.9742 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217 (71)
Water heating gains (Table 5)	126.9343	124.5900	119.7219	113.1037	108.8070	102.7569	97.6145	104.2033	106.5443	113.3943	121.1291	124.5998 (72)
Total internal gains	496.2087	493.9774	477.8043	451.4924	424.3901	398.5333	381.8903	388.3662	402.0122	428.5559	459.0963	482.3736 (73)

6. Solar gains

[Jan]			Area m2			Solar flux Table 6a W/m2	g			FF			Access factor Table 6d			Gains W
							Specific data or Table 6b			Specific data or Table 6c						
North			8.9900			10.6334	0.6300			0.7000			0.7700			29.2148 (74)
East			5.9200			19.6403	0.6300			0.7000			0.7700			35.5337 (76)
West			13.4100			19.6403	0.6300			0.7000			0.7700			80.4911 (80)
Solar gains	145.2397	282.8002	468.6565	697.5310	873.3736	903.6709	856.2852	722.0745	548.7937	335.7776	180.7096	119.7681	(83)			
Total gains	641.4484	776.7777	946.4609	1149.0234	1297.7637	1302.2043	1238.1755	1110.4407	950.8059	764.3335	639.8059	602.1418	(84)			

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, n _{li,m} (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	55.8062	55.9380	56.0678	56.6856	56.8028	57.3544	57.3544	57.4577	57.1406	56.8028	56.5663	56.3213
alpha	4.7204	4.7292	4.7379	4.7790	4.7869	4.8236	4.8236	4.8305	4.8094	4.7869	4.7711	4.7548
util living area	0.9984	0.9958	0.9856	0.9420	0.8240	0.6376	0.4794	0.5506	0.8274	0.9768	0.9966	0.9988 (86)
MIT	19.6034	19.7845	20.1013	20.5120	20.8212	20.9611	20.9920	20.9850	20.8664	20.4325	19.9411	19.5748 (87)
Th 2	19.8847	19.8870	19.8893	19.9000	19.9020	19.9114	19.9114	19.9131	19.9078	19.9020	19.8979	19.8937 (88)
util rest of house	0.9979	0.9944	0.9803	0.9211	0.7678	0.5439	0.3649	0.4287	0.7492	0.9648	0.9951	0.9984 (89)
MIT 2	18.0264	18.2923	18.7533	19.3393	19.7351	19.8872	19.9086	19.9073	19.8033	19.2421	18.5294	17.9909 (90)
Living area fraction	18.4686	18.7108	19.1313	19.6682	20.0397	20.1883	20.2124	20.2095	20.1014	19.5759	18.9252	18.4351 (92)
MIT	18.4686	18.7108	19.1313	19.6682	20.0397	20.1883	20.2124	20.2095	20.1014	19.5759	18.9252	18.4351 (92)
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (93)
adjusted MIT	18.4686	18.7108	19.1313	19.6682	20.0397	20.1883	20.2124	20.2095	20.1014	19.5759	18.9252	18.4351 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9968	0.9921	0.9755	0.9157	0.7756	0.5688	0.3972	0.4631	0.7650	0.9600	0.9932	0.9976 (94)
Ext temp.	639.3998	770.6281	923.2294	1052.1338	1006.6094	740.7411	491.7890	514.2087	727.3614	733.7879	635.4595	600.7058 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1996.9090	1941.8921	1771.9393	1494.1106	1154.7652	766.3521	495.3874	521.4780	826.0752	1242.8590	1644.2407	1987.9294 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	1009.9868	787.0894	631.4402	318.2233	110.2279	0.0000	0.0000	0.0000	0.0000	378.7489	726.3225	1032.0944 (98)
Space heating per m ²	(98) / (4) = 44.0944 (99)											

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)											
Fraction of space heat from main system(s)	1.0000 (202)											
Efficiency of main space heating system 1 (in %)	93.5000 (206)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	5341.3191 (211)											
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating efficiency (main heating system 1)	1009.9868	787.0894	631.4402	318.2233	110.2279	0.0000	0.0000	0.0000	0.0000	378.7489	726.3225	1032.0944 (98)
Space heating efficiency	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000 (210)

Space heating fuel (main heating system)												
1080.1998	841.8069	675.3371	340.3458	117.8908	0.0000	0.0000	0.0000	0.0000	405.0790	776.8155	1103.8442	(211)
Water heating requirement												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement												
214.7915	189.2673	198.6531	177.9138	174.2299	155.5086	149.1857	163.9287	163.7100	184.4945	195.2921	209.5679	(64)
Efficiency of water heater												
(217)m	88.4208	88.2073	87.6863	86.3481	83.6316	79.8000	79.8000	79.8000	79.8000	86.6924	87.9997	79.8000 (216)
Fuel for water heating, kWh/month												
242.9197	214.5711	226.5498	206.0424	208.3302	194.8730	186.9495	205.4245	205.1503	212.8150	221.9237	236.8073	(219)
Water heating fuel used												
Annual totals kWh/year												2562.3563 (219)
Space heating fuel - main system												5341.3191 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												434.7930 (232)
Total delivered energy for all uses												8413.4684 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kwh/year	Emission factor kg CO2/kwh	Emissions kg CO2/year
Space heating - main system 1	5341.3191	0.2160	1153.7249 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2562.3563	0.2160	553.4690 (264)
Space and water heating			1707.1939 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	434.7930	0.5190	225.6576 (268)
Total CO2, kg/m2/year			1971.7764 (272)
Emissions per m2 for space and water heating			15.0732 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			1.9924 (272b)
Emissions per m2 for pumps and fans			0.3437 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.0732 * 1.55) + 1.9924 + 0.3437, rounded to 2 d.p.			25.7000 (273)

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	86.6900 (1b)	x 2.6000 (2b)	= 225.3940 (1b) - (3b)
First floor	26.5700 (1c)	x 2.8500 (2c)	= 75.7245 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 301.1185 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1328 (8)
Pressure test					Yes
Measured/design q50					5.0000
Infiltration rate					0.3020 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3254 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4149	0.4068	0.3986	0.3580	0.3498	0.3091	0.3091	0.3010	0.3254	0.3498	0.3661	0.3824 (22b)
Effective ac	0.5861	0.5827	0.5795	0.5641	0.5612	0.5478	0.5478	0.5453	0.5529	0.5612	0.5670	0.5731 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 0.78)			69.7900	0.7564	52.7892		(27)
penthouse floor			86.6900	0.1500	13.0035		(28a)
External Wall 1	52.7900	38.7700	14.0200	0.8900	12.4778		(29a)
External Wall 2	43.0800	31.0200	12.0600	0.8900	10.7334		(29a)
penthouse roof	61.1200		61.1200	0.1000	6.1120		(30)
garden room roof	25.5700		25.5700	0.1000	2.5570		(30)
Total net area of external elements Aum(A, m ²)			269.2500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	97.6729		(33)
Party Wall 1			59.0900	0.0000	0.0000		(32)
Party Wall 2			25.4200	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9864 (36)
Total fabric heat loss						(33) + (36) =	106.6593 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	58.2374	57.9053	57.5797	56.0507	55.7646	54.4328	54.4328	54.1862	54.9458	55.7646	56.3433	56.9484 (38)
Heat transfer coeff	164.8967	164.5645	164.2390	162.7100	162.4239	161.0921	161.0921	160.8455	161.6051	162.4239	163.0026	163.6077 (39)
Average = Sum(39)m / 12 =												162.7086 (39)
HLP	1.4559	1.4530	1.4501	1.4366	1.4341	1.4223	1.4223	1.4201	1.4269	1.4341	1.4392	1.4445 (40)
HLP (average)												1.4366 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8330 (42)
Average daily hot water use (litres/day)												101.4847 (43)
Daily hot water use	111.6332	107.5738	103.5144	99.4551	95.3957	91.3363	91.3363	95.3957	99.4551	103.5144	107.5738	111.6332 (44)
Energy conte	165.5488	144.7901	149.4104	130.2596	124.9872	107.8544	99.9430	114.6860	116.0558	135.2518	147.6379	160.3252 (45)
Energy content (annual)										Total = Sum(45)m =		1596.7503 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.1791	30.7679	31.7497	27.6802	26.5598	22.9191	21.2379	24.3708	24.6618	28.7410	31.3731	34.0691 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6198	21.8671	17.7835	13.4632	10.0639	8.4964	9.1807	11.9334	16.0169	20.3372	23.7365	25.3040	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	276.1590	279.0247	271.8033	256.4298	237.0236	218.7844	206.5996	203.7339	210.9553	226.3288	245.7350	263.9742	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	(71)
Water heating gains (Table 5)	47.2838	45.7856	42.6743	38.4447	35.6986	31.8320	28.5455	32.7564	34.2526	38.6304	43.5737	45.7918	(72)
Total internal gains	413.5582	412.1729	397.7568	373.8334	348.2818	324.6085	309.8214	313.9193	326.7204	350.7920	378.5408	400.5656	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W	
North	22.1600	10.6334	0.3600	1.0000	0.7700	58.7865	(74)
East	14.5800	19.6403	0.3600	1.0000	0.7700	71.4399	(76)
West	33.0500	19.6403	0.3600	1.0000	0.7700	161.9401	(80)

Solar gains	292.1665	568.8847	942.7575	1403.1736	1756.9145	1817.8674	1722.5417	1452.5498	1103.9650	675.4549	363.5181	240.9277	(83)
Total gains	705.7247	981.0577	1340.5142	1777.0070	2105.1963	2142.4759	2032.3631	1766.4691	1430.6854	1026.2469	742.0589	641.4933	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, n _{li} ,m (see Table 9a)													
tau	19.0793	19.1178	19.1557	19.3357	19.3698	19.5299	19.5299	19.5598	19.4679	19.3698	19.3010	19.2296	
alpha	2.2720	2.2745	2.2770	2.2890	2.2913	2.3020	2.3020	2.3040	2.2979	2.2913	2.2867	2.2820	
util living area	0.9659	0.9316	0.8607	0.7308	0.5750	0.4303	0.3280	0.3841	0.6064	0.8446	0.9463	0.9721	(86)
MIT	18.0446	18.5225	19.2458	20.0383	20.5691	20.8428	20.9392	20.9115	20.6437	19.8189	18.7582	17.9583	(87)
Th 2	19.7207	19.7229	19.7251	19.7354	19.7373	19.7463	19.7463	19.7479	19.7428	19.7373	19.7334	19.7294	(88)
util rest of house	0.9601	0.9207	0.8394	0.6932	0.5207	0.3591	0.2417	0.2908	0.5312	0.8116	0.9358	0.9673	(89)
MIT 2	17.0605	17.5301	18.2294	18.9732	19.4367	19.6602	19.7236	19.7123	19.5242	18.8021	17.7765	16.9809	(90)
Living area fraction									f _{LA} = Living area / (4) =			0.2804	(91)
MIT	17.3364	17.8084	18.5144	19.2719	19.7542	19.9918	20.0645	20.0485	19.8381	19.0872	18.0518	17.2550	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3364	17.8084	18.5144	19.2719	19.7542	19.9918	20.0645	20.0485	19.8381	19.0872	18.0518	17.2550	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9451	0.8991	0.8149	0.6778	0.5214	0.3736	0.2643	0.3142	0.5375	0.7909	0.9169	0.9542	(94)
Ext temp.	666.9729	882.0794	1092.3974	1204.4687	1097.7319	800.4990	537.1453	555.0773	768.9570	811.6182	680.3644	612.0852	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	2149.6654	2124.2617	1973.2327	1687.6034	1308.1965	868.5774	558.1027	586.8509	927.3126	1378.5231	1785.1742	2135.8979	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1103.1232	834.7465	655.3414	347.8570	156.5857	0.0000	0.0000	0.0000	0.0000	421.7772	795.4630	1133.7167	(98)
Space heating per m2												5448.6107	(98)
										(98) / (4) =		48.1071	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1514.2659	1192.0816	1222.4257	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8568	0.8948	0.8636	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1297.4385	1066.6333	1055.7421	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2615.8892	2484.7073	2175.9479	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	949.2844	1055.0470	833.4331	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2837.7646	(104)
Cooled fraction									f _C = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	237.3211	263.7618	208.3583	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												709.4411	(107)
Space cooling per m2												6.2638	(108)
Energy for space heating												48.1071	(99)
Energy for space cooling												6.2638	(108)
Total												54.3709	(109)
Dwelling Fabric Energy Efficiency (DfEE)												54.4	(109)

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	86.6900 (1b)	x 2.6000 (2b)	= 225.3940 (1b) - (3b)
First floor	26.5700 (1c)	x 2.8500 (2c)	= 75.7245 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 301.1185 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1328 (8)
Pressure test					Yes
Measured/design q50					5.0000
Infiltration rate					0.3020 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3254 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4149	0.4068	0.3986	0.3580	0.3498	0.3091	0.3091	0.3010	0.3254	0.3498	0.3661	0.3824 (22b)
Effective ac	0.5861	0.5827	0.5795	0.5641	0.5612	0.5478	0.5478	0.5453	0.5529	0.5612	0.5670	0.5731 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opening Type Curtain (Uw = 1.50)			28.3200	1.4151	40.0755		(27)
penthouse floor			86.6900	0.1300	11.2697		(28a)
External Wall 1	52.7900	15.7400	37.0500	0.1800	6.6690		(29a)
External Wall 2	43.0800	12.5800	30.5000	0.1800	5.4900		(29a)
penthouse roof	61.1200		61.1200	0.1300	7.9456		(30)
garden room roof	25.5700		25.5700	0.1300	3.3241		(30)
Total net area of external elements Aum(A, m2)			269.2500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7739		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9280 (36)
Total fabric heat loss						(33) + (36) =	82.7019 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	58.2374	57.9053	57.5797	56.0507	55.7646	54.4328	54.4328	54.1862	54.9458	55.7646	56.3433	56.9484 (38)
Heat transfer coeff	140.9393	140.6071	140.2816	138.7525	138.4665	137.1347	137.1347	136.8881	137.6477	138.4665	139.0452	139.6502 (39)
Average = Sum(39)m / 12 =												138.7512 (39)
HLP	1.2444	1.2415	1.2386	1.2251	1.2226	1.2108	1.2108	1.2086	1.2153	1.2226	1.2277	1.2330 (40)
HLP (average)												1.2251 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8330 (42)
Average daily hot water use (litres/day)												101.4847 (43)
Daily hot water use	111.6332	107.5738	103.5144	99.4551	95.3957	91.3363	91.3363	95.3957	99.4551	103.5144	107.5738	111.6332 (44)
Energy conte	165.5488	144.7901	149.4104	130.2596	124.9872	107.8544	99.9430	114.6860	116.0558	135.2518	147.6379	160.3252 (45)
Energy content (annual)										Total = Sum(45)m =		1596.7593 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.1791	30.7679	31.7497	27.6802	26.5598	22.9191	21.2379	24.3708	24.6618	28.7410	31.3731	34.0691 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521	141.6521 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6198	21.8671	17.7835	13.4632	10.0639	8.4964	9.1807	11.9334	16.0169	20.3372	23.7365	25.3040 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	276.1590	279.0247	271.8033	256.4298	237.0236	218.7844	206.5996	203.7339	210.9553	226.3288	245.7350	263.9742 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652	37.1652 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217 (71)
Water heating gains (Table 5)	47.2838	45.7856	42.6743	38.4447	35.6986	31.8320	28.5455	32.7564	34.2526	38.6304	43.5737	45.7918 (72)
Total internal gains	413.5582	412.1729	397.7568	373.8334	348.2818	324.6085	309.8214	313.9193	326.7204	350.7920	378.5408	400.5656 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Specific data or Table 6c	Access factor Table 6d				Gains W	
North				8.9900	10.6334	0.6300		0.7000		0.7700				29.2148 (74)
East				5.9200	19.6403	0.6300		0.7000		0.7700				35.5337 (76)
West				13.4100	19.6403	0.6300		0.7000		0.7700				80.4911 (80)
Solar gains	145.2397	282.8002	468.6565	697.5310	873.3736	903.6709	856.2852	722.0745	548.7937	335.7776	180.7096		119.7681 (83)	
Total gains	558.7979	694.9732	866.4133	1071.3644	1221.6554	1228.2794	1166.1066	1035.9938	875.5141	686.5696	559.2504		520.3337 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{li} ,m (see Table 9a)												
tau	55.8062	55.9380	56.0678	56.6856	56.8028	57.3544	57.3544	57.4577	57.1406	56.8028	56.5663	56.3213
alpha	4.7204	4.7292	4.7379	4.7790	4.7869	4.8236	4.8236	4.8305	4.8094	4.7869	4.7711	4.7548
util living area	0.9991	0.9974	0.9899	0.9543	0.8482	0.6676	0.5068	0.5850	0.8597	0.9847	0.9981	0.9994 (86)
MIT	19.5364	19.7190	20.0400	20.4630	20.7942	20.9527	20.9898	20.9807	20.8385	20.3748	19.8761	19.5083 (87)
Th 2	19.8847	19.8870	19.8893	19.9000	19.9020	19.9114	19.9114	19.9131	19.9078	19.9020	19.8979	19.8937 (88)
util rest of house	0.9988	0.9965	0.9861	0.9369	0.7957	0.5726	0.3869	0.4580	0.7882	0.9764	0.9973	0.9992 (89)
MIT 2	18.5491	18.7331	19.0537	19.4726	19.7681	19.8908	19.9090	19.9079	19.8182	19.3965	18.8990	18.5281 (90)
Living area fraction	18.8260	19.0095	19.3303	19.7503	20.0558	20.1886	20.2121	20.2087	20.1043	19.6708	19.1730	18.8030 (92)
MIT	18.8260	19.0095	19.3303	19.7503	20.0558	20.1886	20.2121	20.2087	20.1043	19.6708	19.1730	18.8030 (93)
Temperature adjustment	18.8260	19.0095	19.3303	19.7503	20.0558	20.1886	20.2121	20.2087	20.1043	19.6708	19.1730	18.8030 (93)
adjusted MIT	18.8260	19.0095	19.3303	19.7503	20.0558	20.1886	20.2121	20.2087	20.1043	19.6708	19.1730	18.8030 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9984	0.9954	0.9835	0.9340	0.8040	0.5982	0.4208	0.4940	0.8032	0.9740	0.9965	0.9989 (94)
Useful gains	557.9125	691.8011	852.1293	1000.6816	982.1637	734.7424	490.7235	511.7981	703.1831	668.7501	557.2787	519.7476 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2047.2774	1983.9013	1799.8485	1505.5063	1157.0010	766.3924	495.3379	521.3644	826.4755	1256.0065	1678.6884	2039.3119 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kwh	1108.0875	868.2914	705.1031	363.4738	130.0789	0.0000	0.0000	0.0000	0.0000	436.9187	807.4150	1130.5558 (98)
Space heating												5549.9242 (98)
Space heating per m2												(98) / (4) = 49.0016 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1289.0663	1014.7968	1040.3495	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8944	0.9417	0.9111	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1152.8844	955.6262	947.8164	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1547.3479	1472.1997	1322.1456	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kwh												
	0.0000	0.0000	0.0000	0.0000	0.0000	284.0137	384.3307	278.5009	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												946.8453 (104)
Cooled fraction												1.0000 (105)
fC = cooled area / (4) =												
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kwh												
	0.0000	0.0000	0.0000	0.0000	0.0000	71.0034	96.0827	69.6252	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												236.7113 (107)
Space cooling per m2												2.0900 (108)
Energy for space heating												49.0016 (99)
Energy for space cooling												2.0900 (108)
Total												51.0916 (109)
Target Fabric Energy Efficiency (TFEE)												58.8 (109)

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	86.6900 (1b)	x 2.6000 (2b)	= 225.3940 (1b) - (3b)
First floor	26.5700 (1c)	x 2.8500 (2c)	= 75.7245 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	301.1185 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	Air changes per hour	0.0000 (8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.2500 (18)	
Number of sides sheltered		2 (19)	

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2125 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.2231	0.2125	0.2125	0.1966	0.1966	0.1753	0.1806	0.1700	0.1753	0.1859	0.1859	0.2019 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												54.6000 (23c)
Effective ac	0.4501	0.4395	0.4395	0.4236	0.4236	0.4023	0.4076	0.3970	0.4023	0.4129	0.4129	0.4289 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 0.78)			69.7900	0.7564	52.7892		(27)
penthouse floor			86.6900	0.1500	13.0035		(28a)
External Wall 1	52.7900	38.7700	14.0200	0.8900	12.4778		(29a)
External Wall 2	43.0800	31.0200	12.0600	0.8900	10.7334		(29a)
penthouse roof	61.1200		61.1200	0.1000	6.1120		(30)
garden room roof	25.5700		25.5700	0.1000	2.5570		(30)
Total net area of external elements Aum(A, m ²)			269.2500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		97.6729		(33)
Party Wall 1			59.0900	0.0000	0.0000		(32)
Party Wall 2			25.4200	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9864 (36)
Total fabric heat loss						(33) + (36) =	106.6593 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	44.7285	43.6727	43.6727	42.0890	42.0890	39.9774	40.5053	39.4495	39.9774	41.0332	41.0332	42.6169 (38)
Heat transfer coeff	151.3878	150.3320	150.3320	148.7483	148.7483	146.6367	147.1646	146.1088	146.6367	147.6925	147.6925	149.2762 (39)
Average = Sum(39)m / 12 =												148.3964 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3366	1.3273	1.3273	1.3133	1.3133	1.2947	1.2994	1.2900	1.2947	1.3040	1.3040	1.3180 (40)
HLP (average)												1.3102 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8330 (42)
Average daily hot water use (litres/day)												101.4847 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.6332	107.5738	103.5144	99.4551	95.3957	91.3363	91.3363	95.3957	99.4551	103.5144	107.5738	111.6332 (44)
Energy conte	165.5488	144.7901	149.4104	130.2596	124.9872	107.8544	99.9430	114.6860	116.0558	135.2518	147.6379	160.3252 (45)
Energy content (annual)										Total = Sum(45)m =		1596.7503 (45)
Distribution loss (46)m = 0.15 x (45)m	24.8323	21.7185	22.4116	19.5389	18.7481	16.1782	14.9914	17.2029	17.4084	20.2878	22.1457	24.0488 (46)
Water storage loss:												
Store volume												180.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0115 (51)
Volume factor from Table 2a												0.8736 (52)
Temperature factor from Table 2b												0.5400 (53)

Enter (49) or (54) in (55)	0.9805 (55)										
Total storage loss	30.3965	27.4549	30.3965	29.4160	30.3965	29.4160	30.3965	30.3965	29.4160	30.3965	29.4160 (56)
If cylinder contains dedicated solar storage	30.3965	27.4549	30.3965	29.4160	30.3965	29.4160	30.3965	30.3965	29.4160	30.3965	29.4160 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120 (59)
Total heat required for water heating calculated for each month	219.2077	193.2562	203.0693	182.1875	178.6461	159.7824	153.6019	168.3449	167.9837	188.9107	199.5659 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	219.2077	193.2562	203.0693	182.1875	178.6461	159.7824	153.6019	168.3449	167.9837	188.9107	199.5659 (64)
RHI water heating demand	Total per year (kwh/year) = Sum(64)m =										2228.5403 (64)
Heat gains from water heating, kWh/month	97.9721	86.9156	92.6061	84.8537	84.4853	77.4040	76.1582	81.0602	80.1309	87.8983	90.6320 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	169.9825	169.9825	169.9825	169.9825	169.9825	169.9825	169.9825	169.9825	169.9825	169.9825	169.9825	169.9825 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.5494	54.6677	44.4587	33.6581	25.1598	21.2410	22.9516	29.8334	40.0424	50.8430	59.3413	63.2601 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	412.1776	416.4548	405.6766	382.7311	353.7665	326.5439	308.3575	304.0804	314.8586	337.8041	366.7687	393.9913 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8313	54.8313	54.8313	54.8313	54.8313	54.8313	54.8313	54.8313	54.8313	54.8313	54.8313	54.8313 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217 (71)
Water heating gains (Table 5)	131.6829	129.3386	124.4705	117.8523	113.5556	107.5055	102.3631	108.9519	111.2929	118.1429	125.8777	129.3484 (72)
Total internal gains	719.9021	714.9532	689.0980	648.7337	606.9741	569.7826	548.1644	557.3579	580.6860	621.2821	666.4798	701.0919 (73)

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North	22.1600				11.9814		0.3600		1.0000		0.7700		66.2391 (74)	
East	14.5800				22.3313		0.3600		1.0000		0.7700		81.2283 (76)	
West	33.0500				22.3313		0.3600		1.0000		0.7700		184.1287 (80)	
Solar gains	331.5962	581.8545	953.1019	1460.3445	1778.6108	1967.7911	1845.1354	1593.3525	1209.4628	737.9551	422.8903	270.6511 (83)		
Total gains	1051.4983	1296.8077	1642.1999	2109.0782	2385.5848	2537.5737	2393.2998	2150.7103	1790.1488	1359.2372	1089.3701	971.7430 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.7818	20.9278	20.9278	21.1506	21.1506	21.4551	21.3782	21.5327	21.4551	21.3018	21.3018	21.0758
alpha	2.3855	2.3952	2.3952	2.4100	2.4100	2.4303	2.4252	2.4355	2.4303	2.4201	2.4201	2.4051
util living area	0.9169	0.8724	0.7781	0.6164	0.4472	0.2787	0.1878	0.2132	0.4308	0.7151	0.8718	0.9276 (86)
MIT	19.2844	19.5689	20.0338	20.4958	20.7512	20.8607	20.8822	20.8800	20.8005	20.4218	19.7996	19.2429 (87)
Th 2	19.8122	19.8195	19.8195	19.8304	19.8304	19.8450	19.8413	19.8487	19.8450	19.8377	19.8377	19.8268 (88)
util rest of house	0.9044	0.8545	0.7492	0.5739	0.3928	0.2177	0.1188	0.1382	0.3571	0.6675	0.8504	0.9165 (89)
MIT 2	17.5708	17.9753	18.6166	19.2302	19.5385	19.6649	19.6773	19.6842	19.6147	19.1668	18.3236	17.5224 (90)
Living area fraction	fLA = Living area / (4) =											0.2804 (91)
MIT	18.0513	18.4222	19.0140	19.5851	19.8785	20.0002	20.0152	20.0195	19.9472	19.5187	18.7375	18.0049 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0513	18.4222	19.0140	19.5851	19.8785	20.0002	20.0152	20.0195	19.9472	19.5187	18.7375	18.0049 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8806	0.8288	0.7268	0.5643	0.3952	0.2261	0.1293	0.1495	0.3640	0.6528	0.8255	0.8941 (94)
Ext temp.	925.9755	1074.7774	1193.4713	1190.1506	942.7178	573.6632	309.3521	321.5392	651.5255	887.2975	899.3102	868.8622 (95)
Heat loss rate W	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Month fracti	1960.6689	1927.5803	1745.9549	1440.6454	1023.1695	586.5785	311.2781	324.2901	696.1141	1169.5335	1585.8492	1926.3923 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	769.8119	573.0836	411.0478	180.3562	59.8561	0.0000	0.0000	0.0000	0.0000	209.9835	494.3080	786.8024 (98)
RHI space heating demand	3485.2495 (98)											3485 (98)

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	86.6900 (1b)	x 2.6000 (2b)	= 225.3940 (1b) - (3b)
First floor	26.5700 (1c)	x 2.8500 (2c)	= 75.7245 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	301.1185 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	Air changes per hour
Pressure test		Yes
Measured/design q50		5.0000
Infiltration rate		0.2500 (18)
Number of sides sheltered		2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2125 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												54.6000 (23c)
Effective ac	0.4979	0.4926	0.4873	0.4608	0.4554	0.4289	0.4289	0.4236	0.4395	0.4554	0.4661	0.4767 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 0.78)			69.7900	0.7564	52.7892		(27)
penthouse floor			86.6900	0.1500	13.0035		(28a)
External Wall 1	52.7900	38.7700	14.0200	0.8900	12.4778		(29a)
External Wall 2	43.0800	31.0200	12.0600	0.8900	10.7334		(29a)
penthouse roof	61.1200		61.1200	0.1000	6.1120		(30)
garden room roof	25.5700		25.5700	0.1000	2.5570		(30)
Total net area of external elements Aum(A, m ²)			269.2500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		97.6729		(33)
Party Wall 1			59.0900	0.0000	0.0000		(32)
Party Wall 2			25.4200	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.9864 (36)
Total fabric heat loss	(33) + (36) =	106.6593 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	49.4796	48.9517	48.4238	45.7843	45.2564	42.6169	42.6169	42.0890	43.6727	45.2564	46.3122	47.3680 (38)
Heat transfer coeff	156.1389	155.6110	155.0831	152.4436	151.9157	149.2762	149.2762	148.7483	150.3320	151.9157	152.9715	154.0273 (39)
Average = Sum(39)m / 12 =												152.3116 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3786	1.3739	1.3693	1.3460	1.3413	1.3180	1.3180	1.3133	1.3273	1.3413	1.3506	1.3599 (40)
HLP (average)												1.3448 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.8330 (42)
Average daily hot water use (litres/day)		101.4847 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.6332	107.5738	103.5144	99.4551	95.3957	91.3363	91.3363	95.3957	99.4551	103.5144	107.5738	111.6332 (44)
Energy conte	165.5488	144.7901	149.4104	130.2596	124.9872	107.8544	99.9430	114.6860	116.0558	135.2518	147.6379	160.3252 (45)
Energy content (annual)										Total = Sum(45)m =		1596.7503 (45)
Distribution loss (46)m = 0.15 x (45)m	24.8323	21.7185	22.4116	19.5389	18.7481	16.1782	14.9914	17.2029	17.4084	20.2878	22.1457	24.0488 (46)
Water storage loss:												
Store volume												180.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0115 (51)
Volume factor from Table 2a												0.8736 (52)
Temperature factor from Table 2b												0.5400 (53)

Enter (49) or (54) in (55)												0.9805 (55)
Total storage loss	30.3965	27.4549	30.3965	29.4160	30.3965	29.4160	30.3965	30.3965	29.4160	30.3965	29.4160	30.3965 (56)
If cylinder contains dedicated solar storage	30.3965	27.4549	30.3965	29.4160	30.3965	29.4160	30.3965	30.3965	29.4160	30.3965	29.4160	30.3965 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	219.2077	193.2562	203.0693	182.1875	178.6461	159.7824	153.6019	168.3449	167.9837	188.9107	199.5659	213.9841 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum(63)m =			0.0000 (63)
Output from w/h	219.2077	193.2562	203.0693	182.1875	178.6461	159.7824	153.6019	168.3449	167.9837	188.9107	199.5659	213.9841 (64)
								Total per year (kwh/year) =	Sum(64)m =			2228.5403 (64)
Heat gains from water heating, kWh/month	97.9721	86.9156	92.6061	84.8537	84.4853	77.4040	76.1582	81.0602	80.1309	87.8983	90.6320	96.2352 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	169.9825	169.9825	169.9825	169.9825	169.9825	169.9825	169.9825	169.9825	169.9825	169.9825	169.9825	169.9825 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.5494	54.6677	44.4587	33.6581	25.1598	21.2410	22.9516	29.8334	40.0424	50.8430	59.3413	63.2601 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	412.1776	416.4548	405.6766	382.7311	353.7665	326.5439	308.3575	304.0804	314.8586	337.8041	366.7687	393.9913 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8313	54.8313	54.8313	54.8313	54.8313	54.8313	54.8313	54.8313	54.8313	54.8313	54.8313	54.8313 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217 (71)
Water heating gains (Table 5)	131.6829	129.3386	124.4705	117.8523	113.5556	107.5055	102.3631	108.9519	111.2929	118.1429	125.8777	129.3484 (72)
Total internal gains	719.9021	714.9532	689.0980	648.7337	606.9741	569.7826	548.1644	557.3579	580.6860	621.2821	666.4798	701.0919 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	22.1600	10.6334	0.3600	1.0000	0.7700	58.7865 (74)
East	14.5800	19.6403	0.3600	1.0000	0.7700	71.4399 (76)
West	33.0500	19.6403	0.3600	1.0000	0.7700	161.9401 (80)

Solar gains	292.1665	568.8847	942.7575	1403.1736	1756.9145	1817.8674	1722.5417	1452.5498	1103.9650	675.4549	363.5181	240.9277 (83)
Total gains	1012.0686	1283.8379	1631.8554	2051.9073	2363.8886	2387.6499	2270.7061	2009.9077	1684.6510	1296.7370	1029.9979	942.0196 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n11,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.1494	20.2178	20.2866	20.6379	20.7096	21.0758	21.0758	21.1506	20.9278	20.7096	20.5666	20.4257
alpha	2.3433	2.3479	2.3524	2.3759	2.3806	2.4051	2.4051	2.4100	2.3952	2.3806	2.3711	2.3617
util living area	0.9305	0.8864	0.8041	0.6655	0.5120	0.3724	0.2787	0.3233	0.5240	0.7701	0.8988	0.9395 (86)
MIT	19.0597	19.3850	19.8566	20.3567	20.6630	20.8147	20.8619	20.8503	20.7160	20.2426	19.5591	19.0090 (87)
Th 2	19.7798	19.7834	19.7870	19.8050	19.8086	19.8268	19.8268	19.8304	19.8195	19.8086	19.8014	19.7942 (88)
util rest of house	0.9201	0.8705	0.7785	0.6268	0.4617	0.3115	0.2081	0.2469	0.4548	0.7304	0.8817	0.9304 (89)
MIT 2	17.2270	17.6895	18.3478	19.0296	19.4157	19.6041	19.6488	19.6446	19.5031	18.9099	17.9597	17.1642 (90)
Living area fraction	0.9201	0.8705	0.7785	0.6268	0.4617	0.3115	0.2081	0.2469	0.4548	0.7304	0.8817	0.9304 (91)
MIT	17.7409	18.1649	18.7709	19.4018	19.7655	19.9436	19.9890	19.9827	19.8432	19.2836	18.4082	17.6815 (92)
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (93)
adjusted MIT	17.7409	18.1649	18.7709	19.4018	19.7655	19.9436	19.9890	19.9827	19.8432	19.2836	18.4082	17.6815 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8973	0.8443	0.7535	0.6126	0.4597	0.3178	0.2181	0.2571	0.4563	0.7102	0.8567	0.9091 (94)
Useful gains	908.1205	1083.8966	1229.6684	1257.0284	1086.7848	758.7097	495.2077	516.7741	768.7144	920.9615	882.4169	856.4356 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2098.6536	2064.1670	1903.0140	1600.9260	1225.2724	797.6675	505.8955	532.9242	863.3885	1319.1764	1729.8353	2076.5250 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	885.7566	658.7417	500.9691	247.6063	103.0348	0.0000	0.0000	0.0000	0.0000	296.2719	610.1412	907.7465 (98)
Space heating	4210.2682 (98)											
Space heating per m2	(98) / (4) = 37.1735 (99)											

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1403.1963	1104.6439	1130.4871	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8879	0.9200	0.8954	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1245.8566	1016.3174	1012.2793	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2691.5626	2558.5249	2252.1433	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	1040.9084	1147.4024	922.4588	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												3110.7696 (104)
Intermittency factor (Table 10b)												0.7095 (105)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kwh	0.0000	0.0000	0.0000	0.0000	0.0000	184.6358	203.5256	163.6253	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												551.7867 (107)
Space cooling per m2												4.8719 (108)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												170.0000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2476.6283 (211)
Cooling System Energy Efficiency Ratio (see Table 10c)												4.0000 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	885.7566	658.7417	500.9691	247.6063	103.0348	0.0000	0.0000	0.0000	0.0000	296.2719	610.1412	907.7465	(98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)
Space heating fuel (main heating system)	521.0333	387.4951	294.6877	145.6507	60.6087	0.0000	0.0000	0.0000	0.0000	174.2776	358.9066	533.9685	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	219.2077	193.2562	203.0693	182.1875	178.6461	159.7824	153.6019	168.3449	167.9837	188.9107	199.5659	213.9841	(64)
Efficiency of water heater (217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(216)
Fuel for water heating, kwh/month	128.9457	113.6801	119.4525	107.1691	105.0859	93.9896	90.3540	99.0264	98.8139	111.1239	117.3917	125.8730	(219)
Water heating fuel used												1310.9061	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	46.1589	50.8814	40.9063	0.0000	0.0000	0.0000	0.0000	(221)
Cooling												137.9467	(221)
Annual totals kwh/year													
Space heating fuel - main system												2476.6283	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7625)													
mechanical ventilation fans (SFP = 0.7625)													280.1155 (230a)
central heating pump													30.0000 (230c)
Total electricity for the above, kwh/year													310.1155 (231)
Electricity for lighting (calculated in Appendix L)													434.7930 (232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.64 * 1000 * 1.00) =										-1416.3363		-1416.3363	(233)
Total delivered energy for all uses												3254.0532	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kwh/year	Fuel price p/kwh	Fuel cost £/year	
Space heating - main system 1	2476.6283	13.1900	326.6673	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1310.9061	13.1900	172.9085	(247)
Space cooling	137.9467	13.1900	18.1952	(248)
Mechanical ventilation fans	280.1155	13.1900	36.9472	(249)
Pumps and fans for heating	30.0000	13.1900	3.9570	(249)
Energy for lighting	434.7930	13.1900	57.3492	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-1416.3363	13.1900	-186.8148	(252)
Total energy cost			429.2096	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	1.1391 (257)
SAP value			84.1101
SAP rating (Section 12)			84 (258)
SAP band			B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kwh/year	Emission factor kg CO2/kwh	Emissions kg CO2/year	
Space heating - main system 1	2476.6283	0.5190	1285.3701	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1310.9061	0.5190	680.3603	(264)
Space and water heating			1965.7304	(265)
Space cooling	137.9467	0.5190	71.5943	(266)
Pumps and fans	310.1155	0.5190	160.9499	(267)
Energy for lighting	434.7930	0.5190	225.6576	(268)
Energy saving/generation technologies				
PV Unit	-1416.3363	0.5190	-735.0785	(269)
Total kg/year			1688.8536	(272)
CO2 emissions per m2			14.9100	(273)
EI value			85.7003	
EI rating			86	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.25) / 1.7000 = 8.321$, stars = 2
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.25) / 1.7000 = 0.3274$, stars = 4
Water heating energy efficiency	$13.19 / 1.7000 = 7.759$, stars = 2
Water heating environmental impact	$0.519 / 1.7000 = 0.3053$, stars = 4

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	86.6900 (1b)	x 2.6000 (2b)	= 225.3940 (1b) - (3b)
First floor	26.5700 (1c)	x 2.8500 (2c)	= 75.7245 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	301.1185 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	Air changes per hour
Pressure test		Yes
Measured/design q50		5.0000
Infiltration rate		0.2500 (18)
Number of sides sheltered		2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2125 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.2231	0.2125	0.2125	0.1966	0.1966	0.1753	0.1806	0.1700	0.1753	0.1859	0.1859	0.2019 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												54.6000 (23c)
Effective ac	0.4501	0.4395	0.4395	0.4236	0.4236	0.4023	0.4076	0.3970	0.4023	0.4129	0.4129	0.4289 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Opening Type 1 (Uw = 0.78)			69.7900	0.7564	52.7892		(27)
penthouse floor			86.6900	0.1500	13.0035		(28a)
External Wall 1	52.7900	38.7700	14.0200	0.8900	12.4778		(29a)
External Wall 2	43.0800	31.0200	12.0600	0.8900	10.7334		(29a)
penthouse roof	61.1200		61.1200	0.1000	6.1120		(30)
garden room roof	25.5700		25.5700	0.1000	2.5570		(30)
Total net area of external elements Aum(A, m2)			269.2500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		97.6729		(33)
Party Wall 1			59.0900	0.0000	0.0000		(32)
Party Wall 2			25.4200	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.9864 (36)
Total fabric heat loss	(33) + (36) =	106.6593 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	44.7285	43.6727	43.6727	42.0890	42.0890	39.9774	40.5053	39.4495	39.9774	41.0332	41.0332	42.6169 (38)
Average = Sum(39)m / 12 =	151.3878	150.3320	150.3320	148.7483	148.7483	146.6367	147.1646	146.1088	146.6367	147.6925	147.6925	149.2762 (39)
	148.3964											(39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3366	1.3273	1.3273	1.3133	1.3133	1.2947	1.2994	1.2900	1.2947	1.3040	1.3040	1.3180 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8330 (42)
Average daily hot water use (litres/day)												101.4847 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	111.6332	107.5738	103.5144	99.4551	95.3957	91.3363	91.3363	95.3957	99.4551	103.5144	107.5738	111.6332 (44)
Energy content (annual)	165.5488	144.7901	149.4104	130.2596	124.9872	107.8544	99.9430	114.6860	116.0558	135.2518	147.6379	160.3252 (45)
Distribution loss (46)m = 0.15 x (45)m	24.8323	21.7185	22.4116	19.5389	18.7481	16.1782	14.9914	17.2029	17.4084	20.2878	22.1457	24.0488 (46)
Water storage loss:												
Store volume												180.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0115 (51)
Volume factor from Table 2a												0.8736 (52)
Temperature factor from Table 2b												0.5400 (53)

Enter (49) or (54) in (55)												0.9805 (55)
Total storage loss	30.3965	27.4549	30.3965	29.4160	30.3965	29.4160	30.3965	30.3965	29.4160	30.3965	29.4160	30.3965 (56)
If cylinder contains dedicated solar storage	30.3965	27.4549	30.3965	29.4160	30.3965	29.4160	30.3965	30.3965	29.4160	30.3965	29.4160	30.3965 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	219.2077	193.2562	203.0693	182.1875	178.6461	159.7824	153.6019	168.3449	167.9837	188.9107	199.5659	213.9841 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	219.2077	193.2562	203.0693	182.1875	178.6461	159.7824	153.6019	Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Heat gains from water heating, kWh/month	97.9721	86.9156	92.6061	84.8537	84.4853	77.4040	76.1582	81.0602	80.1309	87.8983	90.6320	96.2352 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	169.9825	169.9825	169.9825	169.9825	169.9825	169.9825	169.9825	169.9825	169.9825	169.9825	169.9825	169.9825 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.5494	54.6677	44.4587	33.6581	25.1598	21.2410	22.9516	29.8334	40.0424	50.8430	59.3413	63.2601 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	412.1776	416.4548	405.6766	382.7311	353.7665	326.5439	308.3575	304.0804	314.8586	337.8041	366.7687	393.9913 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8313	54.8313	54.8313	54.8313	54.8313	54.8313	54.8313	54.8313	54.8313	54.8313	54.8313	54.8313 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217	-113.3217 (71)
Water heating gains (Table 5)	131.6829	129.3386	124.4705	117.8523	113.5556	107.5055	102.3631	108.9519	111.2929	118.1429	125.8777	129.3484 (72)
Total internal gains	719.9021	714.9532	689.0980	648.7337	606.9741	569.7826	548.1644	557.3579	580.6860	621.2821	666.4798	701.0919 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	22.1600	11.9814	0.3600	1.0000	0.7700	66.2391 (74)
East	14.5800	22.3313	0.3600	1.0000	0.7700	81.2283 (76)
West	33.0500	22.3313	0.3600	1.0000	0.7700	184.1287 (80)

Solar gains	331.5962	581.8545	953.1019	1460.3445	1778.6108	1967.7911	1845.1354	1593.3525	1209.4628	737.9551	422.8903	270.6511 (83)
Total gains	1051.4983	1296.8077	1642.1999	2109.0782	2385.5848	2537.5737	2393.2998	2150.7103	1790.1488	1359.2372	1089.3701	971.7430 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nli,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.7818	20.9278	20.9278	21.1506	21.1506	21.4551	21.3782	21.5327	21.4551	21.3018	21.3018	21.0758	
alpha	2.3855	2.3952	2.3952	2.4100	2.4100	2.4303	2.4252	2.4355	2.4303	2.4201	2.4201	2.4051	
util living area	0.9169	0.8724	0.7781	0.6164	0.4472	0.2787	0.1878	0.2132	0.4308	0.7151	0.8718	0.9276 (86)	
MIT	19.2844	19.5689	20.0338	20.4958	20.7512	20.8607	20.8822	20.8800	20.8005	20.4218	19.7996	19.2429 (87)	
Th 2	19.8122	19.8195	19.8195	19.8304	19.8304	19.8450	19.8413	19.8487	19.8450	19.8377	19.8377	19.8268 (88)	
util rest of house	0.9044	0.8545	0.7492	0.5739	0.3928	0.2177	0.1188	0.1382	0.3571	0.6675	0.8504	0.9165 (89)	
MIT 2	17.5708	17.9753	18.6166	19.2302	19.5385	19.6649	19.6773	19.6842	19.6147	19.1668	18.3236	17.5224 (90)	
Living area fraction	18.0513	18.4222	19.0140	19.5851	19.8785	20.0002	20.0152	20.0195	fLA = Living area / (4) =				0.2804 (91)
MIT	18.0513	18.4222	19.0140	19.5851	19.8785	20.0002	20.0152	20.0195	19.9472	19.5187	18.7375	18.0049 (92)	
Temperature adjustment	18.0513	18.4222	19.0140	19.5851	19.8785	20.0002	20.0152	20.0195	19.9472	19.5187	18.7375	0.0000	
adjusted MIT	18.0513	18.4222	19.0140	19.5851	19.8785	20.0002	20.0152	20.0195	19.9472	19.5187	18.7375	18.0049 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8806	0.8288	0.7268	0.5643	0.3952	0.2261	0.1293	0.1495	0.3640	0.6528	0.8255	0.8941 (94)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1960.6689	1927.5803	1745.9549	1440.6454	1023.1695	586.5785	311.2781	324.2901	696.1141	1169.5335	1585.8492	1926.3923 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	769.8119	573.0836	411.0478	180.3562	59.8561	0.0000	0.0000	0.0000	0.0000	209.9835	494.3080	786.8024 (98)
Space heating												3485.2495 (98)
Space heating per m2												(98) / (4) = 30.7721 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1173.0937	897.7041	905.8746	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9294	0.9528	0.9407	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1090.2253	855.3096	852.1306	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2866.7982	2701.8162	2416.7179	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												

Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	1279.1325	1373.8009	1164.0529	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												3816.9863 (104)
Intermittency factor (Table 10b)												0.7095 (105)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kwh	0.0000	0.0000	0.0000	0.0000	0.0000	226.8919	243.6841	206.4791	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												677.0551 (107)
Space cooling per m2												5.9779 (108)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												170.0000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2050.1467 (211)
Cooling System Energy Efficiency Ratio (see Table 10c)												4.0000 (209)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	769.8119	573.0836	411.0478	180.3562	59.8561	0.0000	0.0000	0.0000	0.0000	209.9835	494.3080	786.8024 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	452.8305	337.1080	241.7928	106.0919	35.2094	0.0000	0.0000	0.0000	0.0000	123.5197	290.7694	462.8249 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	219.2077	193.2562	203.0693	182.1875	178.6461	159.7824	153.6019	168.3449	167.9837	188.9107	199.5659	213.9841 (64)
Efficiency of water heater	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kwh/month	128.9457	113.6801	119.4525	107.1691	105.0859	93.9896	90.3540	99.0264	98.8139	111.1239	117.3917	125.8730 (219)
Water heating fuel used	0.0000	0.0000	0.0000	0.0000	0.0000	56.7230	60.9210	51.6198	0.0000	0.0000	0.0000	1310.9061 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	56.7230	60.9210	51.6198	0.0000	0.0000	0.0000	0.0000 (221)
(221)m												169.2638 (221)
Cooling												
Annual totals kwh/year												
Space heating fuel - main system												2050.1467 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7625)												
mechanical ventilation fans (SFP = 0.7625)												280.1155 (230a)
central heating pump												30.0000 (230c)
Total electricity for the above, kwh/year												310.1155 (231)
Electricity for lighting (calculated in Appendix L)												434.7930 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.64 * 1140 * 1.00) =										-1495.8109		-1495.8109 (233)
Total delivered energy for all uses												2779.4141 (238)

10a. Fuel costs - using BEDF prices (401)

	Fuel	Fuel price	Fuel cost
	kwh/year	p/kwh	£/year
Space heating - main system 1	2050.1467	15.4400	316.5427 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1310.9061	15.4400	202.4039 (247)
Space cooling	169.2638	15.4400	26.1343 (248)
Mechanical ventilation fans	280.1155	15.4400	43.2498 (249)
Pumps and fans for heating	30.0000	15.4400	4.6320 (249)
Energy for lighting	434.7930	15.4400	67.1320 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1495.8109	15.4400	-230.9532 (252)
Total energy cost			429.1415 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy	Emission factor	Emissions
	kwh/year	kg CO2/kwh	kg CO2/year
Space heating - main system 1	2050.1467	0.5190	1064.0262 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1310.9061	0.5190	680.3603 (264)
Space and water heating			1744.3864 (265)
Space cooling	169.2638	0.5190	87.8479 (266)
Pumps and fans	310.1155	0.5190	160.9499 (267)
Energy for lighting	434.7930	0.5190	225.6576 (268)
Energy saving/generation technologies			
PV Unit	-1495.8109	0.5190	-776.3259 (269)
Total kg/year			1442.5159 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy	Primary energy factor	Primary energy
	kwh/year	kg CO2/kwh	kwh/year
Space heating - main system 1	2050.1467	3.0700	6293.9505 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1310.9061	3.0700	4024.4817 (264)
Space and water heating			10318.4322 (265)
Space cooling	169.2638	3.0700	519.6398 (266)
Pumps and fans	310.1155	3.0700	952.0545 (267)
Energy for lighting	434.7930	3.0700	1334.8144 (268)

Energy saving/generation technologies			
PV Unit	-1495.8109	3.0700	-4592.1395 (269)
Primary energy kWh/year			8532.8014 (272)
Primary energy kWh/m2/year			75.3382 (273)

 SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 84
Current environmental impact rating:	B 86

(For testing purposes):	
A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating:	B 84
Potential environmental impact rating:	B 86

Fuel prices for cost data on this page from database revision number 401 TEST (27 Oct 2016)
 Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£660	£660	£0
Space heating	£364	£364	£0
Space cooling	£26	£26	£0
Water heating	£202	£202	£0
Lighting	£67	£67	£0
Generated (PV)	-£231	-£231	£0
Total cost of fuels	£429	£429	£0
Total cost of uses	£428	£428	£0
Delivered energy	25 kWh/m²	25 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.4 tonnes	1.4 tonnes	0.0 tonnes
CO2 emissions per m²	13 kg/m²	13 kg/m²	0 kg/m²
Primary energy	75 kWh/m²	75 kWh/m²	0 kWh/m²

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type EndTerrace Flat
 Number of storeys 2
 Cross ventilation possible Yes
 SAP Region Thames Valley
 Front of dwelling faces East
 Overshading Average or unknown
 Thermal mass parameter 100.0
 Night ventilation No
 Ventilation rate during hot weather (ach) 8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient 794.95 (P1)
 Transmission heat loss coefficient 106.66 (37)
 Summer heat loss coefficient 901.61 (P2)

Overhangs Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	1.000	0.90	1.000	0.900 (P8)
East	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	22.1600	81.1852	0.3600	1.0000	0.9000	524.6069
East	14.5800	117.5071	0.3600	1.0000	0.9000	499.5846
West	33.0500	117.5071	0.3600	1.0000	0.9000	1132.4603
total:						2156.6518

	Jun	Jul	Aug	
Solar gains	2300	2157	1862	(P3)
Internal gains	567	545	554	
Total summer gains	2867	2702	2417	(P5)
Summer gain/loss ratio	3.18	3.00	2.68	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	20.48	22.20	21.78	(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight	
Assessment of likelihood of high internal temperature:	Medium			

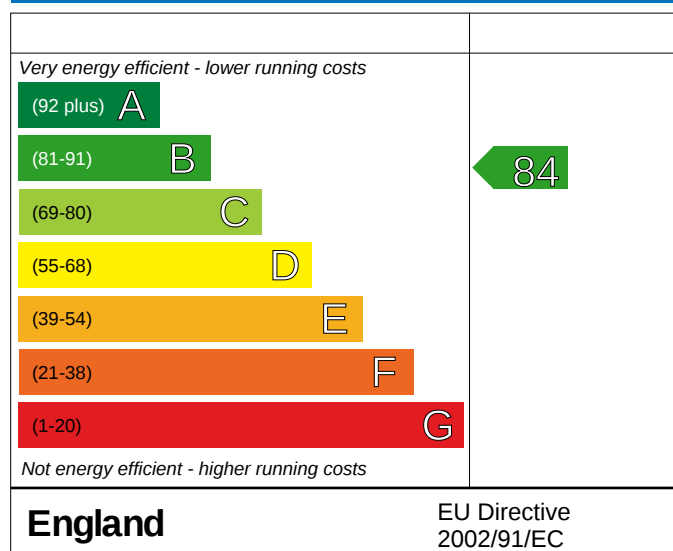
506,
London

Dwelling type: Flat, End-Terrace
Date of assessment: 01.Nov.2016
Produced by: Gecko
Total floor area: 113.26 m²

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

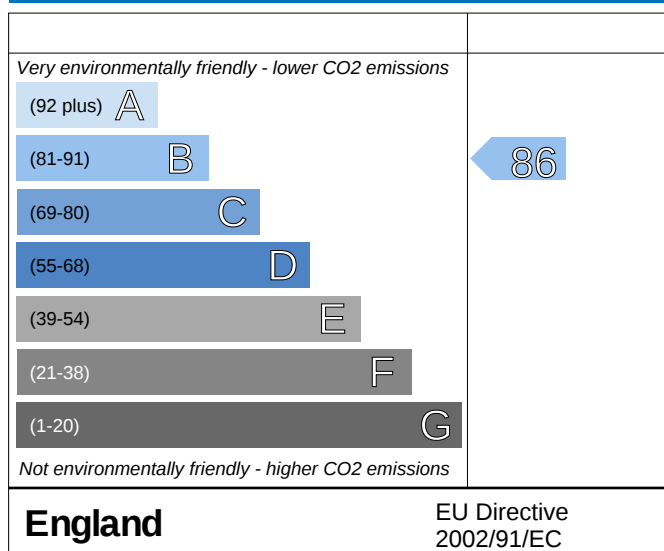
The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO₂) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

SURVEY NOTES

Property Reference: 506 Linton House

Issued on Date: 01.Nov.2016

Survey Reference: 506 design

Prop Type Ref:

Property: 506, London

SAP Rating: 84 B	CO2 Emissions (t/year): 1.44	DER: 16.23 Pass	TER: 25.70	Percentage DER<TER: 36.85 %
Environmental: 86 B	General Requirements Compliance: Pass	DFEE: 54.37 Pass	TFEE: 58.76	Percentage DFEE<TFEE: 7.46 %

CfSH Results Version: November 2010 - June 2014 Addendum **ENE1 Credits:** 4.4 **ENE2 Credits:** 0.0 **ENE7 Credits:** 0 **CfSH Level:** 4

Surveyor: Mike Ovenden, Tel: 01908 850109

Surveyor ID: H824-0001

Address: Dudley Hill, Shenley Church End, Milton Keynes, Buckinghamshire, MK5 6LL

Client: Synergy, 3

Software Version: Elmhurst Energy Systems SAP2012 Calculator (Design System) version 3.06r08

SAP version: SAP 2012, Regs Region: England (Part L1A 2013), Calculation Type: New Build (As Designed)

SURVEY NOTES - Last time updated on: 01.11.2016

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Summary Information

Property Reference: 506 Linton House

Survey Reference: 506 design

Issued on Date: 01.Nov.2016

Prop Type Ref:

Property: 506, London

SAP Rating: 84 B **CO2 Emissions (t/year):** 1.44 **DER:** 16.23 Pass **TER:** 25.70 **Percentage DER<TER:** 36.85 %
Environmental: 86 B **General Requirements Compliance:** Pass **DFEE:** 54.37 Pass **TFEE:** 58.76 **Percentage DFEE<TFEE:** 7.46 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 4.4 **ENE2 Credits:** 0.0 **ENE7 Credits:** 0 **CfSH Level:** 4

Surveyor: Mike Ovenden, Tel: 01908 850109

Surveyor ID: H824-0001

Address: Dudley Hill, Shenley Church End, Milton Keynes, Buckinghamshire, MK5 6LL

Client: Synergy, 3

Software Version: Elmhurst Energy Systems SAP2012 Calculator (Design System) version 3.06r08

SAP version: SAP 2012, **Regs Region:** England (Part L1A 2013), **Calculation Type:** New Build (As Designed)

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Page 35 of 39

Orientation	East
1.0 Property Type	Flat, End-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2016
3.0 Property Age Band	
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown
6.0 Measurements	

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	20.30	86.69	2.60
1st Storey:	15.12	26.57	2.85

7.0 Living Area	31.76
8.0 Thermal Mass Parameter	Simple calculation - Low

9.0 External Walls	Description	Construction	U-Value	Kappa	Gross Area	Nett Area
External Wall 1	Other		0.89		52.79	14.02
External Wall 2	Other		0.89		43.08	12.06

9.1 Party walls	Description	Construction	Kappa	Area
Party Wall 1	Steel frame			59.09
Party Wall 2	Steel frame			25.42

10.0 External Roofs	Description	Construction	U-Value	Kappa	Gross Area	Nett Area
penthouse roof	Other		0.10		61.12	61.12
garden room roof	Other		0.10		25.57	25.57

11.0 HeatLoss Floors	Description	Construction	U-Value	Kappa	Area
penthouse floor	Other		0.15		86.69

12.0 Opening Types	Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	Solar Trans	Frame Type	Frame Factor	U value
Opening Type 1	Manufacturer	Window		Double Low-E Soft 0.05			0.36		1.00	0.78

13.0 Openings	Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width	Height	Count	Area	Curtain Closed
1	Window		[1] External Wall 1	West	None	0.00					3.89	
2	Window		[1] External Wall 1	East	None	0.00					7.29	
3	Window		[1] External Wall 1	East	None	0.00					7.29	

4	Window	[1] External Wall 1	West	None	0.00	7.29
1gh	Window	[2] External Wall 2	West	None	0.00	21.87
5	Window	[1] External Wall 1	North	None	0.00	4.37
6	Window	[1] External Wall 1	North	None	0.00	6.48
7	Window	[1] External Wall 1	North	None	0.00	2.16
2gh	Window	[2] External Wall 2	North	None	0.00	9.15

14.0 Conservatory None

15.0 Draught Proofing 100

16.0 Draught Lobby No

17.0 Thermal Bridging Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E5 Ground floor (normal)	20.30	0.160	No
Table K1 - Approved	E6 Intermediate floor within a dwelling	15.12	0.070	Yes
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	20.30	0.070	Yes
Table K1 - Default	E14 Flat roof	20.30	0.080	No
Table K1 - Approved	E16 Corner (normal)	10.90	0.090	Yes
Table K1 - Approved	E18 Party wall between dwellings	10.90	0.060	Yes

18.0 Pressure Testing Yes

Designed q50 5.00

Property Tested ?

As Built q50

Same As Designed ?

19.0 Mechanical Ventilation

Mechanical Ventilation System Yes

Present

Approved Installation Yes

Windows open in hot weather Windows fully open

Cross ventilation possible Yes

Night Ventilation No

Air change rate 8.00

Mechanical Ventilation data Type Database

Type Balanced mechanical ventilation with heat recovery

MV Reference Number 500320

Configuration 2

MVHR Duct Insulated No

Manufacturer SFP 0.61

Duct Type Rigid

MVHR Efficiency 78.00

Wet Rooms 2

Brand, Model

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				0
Number of passive vents				0
Number of flueless gas fires				0

21.0 Cooling System Yes

Cooled Area 80.36

Data Source SAP table

Cooling Type Split or Multi-Split

Energy Class A

Energy Efficiency Ratio

System Control On/Off

22.0 Lighting

Internal

Total number of light fittings 52

Total number of L.E.L. fittings 52

Percentage of L.E.L. fittings 100.00

External

External lights fitted Yes

Light and motion sensors Yes

23.0 Electricity Tariff Standard

24.0 Heating Systems

Main Heating 1 SAP table

Description ashp

Percentage of Heat 100 %

Main Heating 2	None
Description	
Percentage of Heat	%
Community Heating	
Secondary Heating	None
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery	No
Instantaneous System 1	
Waste Water Heat Recovery	No
Instantaneous System 2	
Waste Water Heat Recovery Storage	No
System	
Solar Panel	No

25.0 Main Heating 1

Database Ref. No.	
Fuel Type	
Main Heating	PET
TestMethod	
SAP Code	224
Efficiency (SAP Table) %	170.0
Efficiency (SAP Table) %	
In Winter	
In Summer	
Model Name	
Manufacturer	
Controls	CHD Time and temperature zone control
PCDF Controls	0
Delayed Start Stat	
Sap Code	2207
Burner Control	
Boiler Compensator	
HETAS approved System	
Oil Pump Inside	
FI Case	
FI Water	
Flue Type	
Smoke Control Area	
Fan Assisted Flue	
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators and Underfloor
Underfloor Heating	Yes - Pipes in thin screed
Flow Temperature	<= 35°C
Electric CPSU Temperature	
Combi boiler type	
Combi keep hot type	
Combi store type	

27.0 Community Heating

Space Community Heating	
PCDF Index	
Distribution Loss	
Distribution Loss Value	
Controls	
SAP Code	
Water Community Heating	
PCDF Index	
Distribution Loss	
Distribution Loss Value	
Charging Linked To Heat Use	

28.0 Secondary Heating

Description	
SHS efficiency %	
SAP Code	
HETAS Approved System	
Smoke Control Area	
Test Method	
Manufacturer	
Model Name	

29.0 Water Heating

Water use <= 125 litres/person/day	Yes
SAP Code	901
Immersion Heater	
Summer Immersion	
Supplementary Immersion	No
Immersion Only Heating Hot Water	

29.1 Flue Gas Heat Recovery System

Database ID

Brand Model

Details

29.2 Waste Water Heat Recovery

System

Total rooms with shower and/or bath

30.0 Hot Water Cylinder	Hot Water Cylinder
Cylinder Stat	Yes
Cylinder In Heated Space	Yes
Independent Time Control	Yes
Insulation Type	Foam
Insulation Thickness	
Cylinder Volume	180.00
Loss (kwh/day)	
Pipes insulation	Fully insulated primary pipework
In Airing Cupboard	

31.0 Solar Panel

Solar Panel Area

Area Type

Panel Type

n0, a1, a2, A/G ratio

Orientation

Elevation

Overshading

Solar Storage Volume

Pump electrically powered

Combined Cylinder

32.0 Thermal Store		None	
Thermal Store Pipework			
33.0 Photovoltaic Unit		One Dwelling	
Apportioned KWh/Year			
PV Cells kW Peak	Orientation	Elevation	Overshading
1.64	South	30°	None Or Little

34.0 Wind Turbines

Terrain Type Urban

Wind Turbines

Count

Apportioned Kwh/year

Rotor Diameter

Hub Height

35.0 Small-scale Hydro

Electricity Generated

Description

Apportioned kWh/Year

Recommendations

None

Further measures to achieve even higher standards

None

Thermal Bridging

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Property Reference: 506 Linton House

Issued on Date: 01.Nov.2016

Survey Reference: 506 design

Prop Type Ref:
Property: 506, London

SAP Rating: 84 B **CO2 Emissions (t/year):** 1.44 **DER:** 16.23 Pass **TER:** 25.70 **Percentage DER<TER:** 36.85 %
Environmental: 86 B **General Requirements Compliance:** Pass **DFEE:** 54.37 Pass **TFEE:** 58.76 **Percentage DFEE<TFEE:** 7.46 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 4.4 **ENE2 Credits:** 0.0 **ENE7 Credits:** 0 **CfSH Level:** 4

Surveyor: Mike Ovenden, Tel: 01908 850109

Surveyor ID: H824-0001

Address: Dudley Hill, Shenley Church End, Milton Keynes, Buckinghamshire, MK5 6LL

Client: Synergy, 3

Software Version: Elmhurst Energy Systems SAP2012 Calculator (Design System) version 3.06r08

SAP version: SAP 2012, Regs Region: England (Part L1A 2013), Calculation Type: New Build (As Designed)

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	20.30	3.25	
External wall	E6 Intermediate floor within a dwelling	Table K1 - Approved	0.070	15.12	1.06	
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Approved	0.070	20.30	1.42	
External wall	E14 Flat roof	Table K1 - Default	0.080	20.30	1.62	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	10.90	0.98	
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	10.90	0.65	

Total W/mK: 8.99

Y-Value W/m2K: 0.033